# 3D modeling of blobs with the BOUT++ code*

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The edge region in a tokamak during L-mode is characterized by strong fluctuations of plasma parameters, in particular, on the outer side of the torus. Occasionally, so-called “blobs” (filamentary structures extended along the magnetic field and having radially and poloidally isolated bumps on plasma density profile) are formed in the vicinity of core-edge boundary and propagate to the SOL (e.g. see Ref. 1 and the references therein). It is estimated that blobs only contribute to ~50% of plasma particle transport in some vicinity of the last closed flux surface [2]. However, an increase of relative amplitude of intermittent fluctuations further into SOL [3] suggests that blobs play a dominant role (<~50%) in far SOL plasma transport and plasma-wall interactions.

There is a large body of theoretical papers devoted to the study of dynamics of individual blobs (e.g. see Ref. 4 and the references therein). However, practically all of these studies adopt 2D fluid approach for blob governing equations by invoking different schemes for closure of 3D plasma dynamic equations in the direction parallel to the magnetic field lines. To the best of our knowledge, 3D dynamics of blobs are only considered in References 5 and 6 using PIC and BOUT codes respectively, but with no detailed analysis of the results. 3D features can have a very important impact on blob dynamics. For example, the variation of blob’s plasma parameters along the magnetic field can result in electrostatic potential variation, which can spin up plasma and, therefore, alter blob propagation dynamics [4].

Here we present the results of 3D simulation of the blob in a sheath-limited regime using the BOUT++ code [8]. We investigate an impact of blob’s plasma density variation along the magnetic field line on blob spinning and advection and compare our numerical results with analytic estimates.

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